

56. A hybrid optical steering system comprising:

a first substrate body defined by an upper surface and a lower surface and formed with at least one cavity including an upper cavity formed on the upper surface of the substrate body and a primary optical path for accommodating the passage of a light beam aligned in a predetermined orientation with the upper cavity;

a second substrate body defined by an upper surface and a lower surface, said second substrate body having a lower cavity formed on its upper surface, said lower cavity having a predetermined alignment with respect to the upper cavity;

a suspended bridge spanning the primary optical path at a juncture between the primary optical path and the upper cavity;

a beam steering assembly having a steerable element positioned substantially adjacent the upper cavity for controllably directing the light beam through at least a portion of the first substrate body; and

a hinge for flexibly anchoring the beam steering assembly to the suspended bridge wherein the beam steering assembly has at least one reflective surface and is rotated towards the upper cavity so that an impinging beam of light emanating from the primary optical path is controllably deflected in a direction generally from the upper cavity to the lower cavity and an impinging beam of light entering from the lower cavity is controllably deflected in a direction generally from the lower cavity to the upper cavity towards the primary optical path.

59. A micro-machined steerable optical device comprising:

a single substrate body defined by an upper surface and formed with at least one cavity including an upper cavity formed on the upper surface of the substrate body, and a primary optical path for accommodating the passage of a light beam aligned in a predetermined orientation with the upper cavity;

a beam steering assembly having a steerable element positioned substantially adjacent to the upper cavity for controllable directing the light beam through at least a portion of the substrate body; and

a frame and micromirror nested in a set of hinges that provides an axis of rotation of the micromirror with respect to the frame and wherein the frame holds the set of the hinges and is connected to the upper surface of the substrate body so that the beam steering assembly may deflect a light beam in a direction towards a surface of the substrate.

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5. The steerable optical device according to claim 63 wherein the micromirror is defined by an external surface and is formed with a conductive film adjacent to its external surface and across the at least one set of hinges so that the micromirror is in electrical communication with the electronic control means.

6. A micro-machined steerable optical device comprising:
a single substrate body defined by an upper surface and formed with at least one cavity including an upper cavity formed on the upper surface of the substrate body, and a primary optical path for accommodating the passage of a light beam aligned in a predetermined orientation with the upper cavity;

a beam steering assembly having a steerable element positioned substantially adjacent to the upper cavity for controllably directing the light beam through at least a portion of the substrate body; and

a frame and a hybrid micromirror nested in at least one set of hinges including a relatively outermost set of hinges that provides additional axes of rotation of the hybrid micromirror with respect to the frame and wherein the frame holds an outermost set of the hinges and is connected to the upper surface of the substrate body so that the beam steering assembly may deflect a light beam in a direction towards a surface of the substrate.

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70. An optical head assembly comprising:
a single substrate body defined by an upper surface and formed with at least one cavity including an upper cavity formed on the upper surface of the substrate body and a primary optical path for accommodating the passage of a light beam aligned in a predetermined orientation with the upper cavity; and
a beam steering assembly rigidly affixed in a predetermined orientation within at least a portion of the upper cavity having a steerable element positioned substantially adjacent the upper cavity for controllably directing the light beam through at least a portion of the upper cavity.

REMARKS

Claims 44-50, 55 and 70 are rejected under 35 U.S.C. 102(e) as being anticipated by Germann et al. (WO 95/13638).